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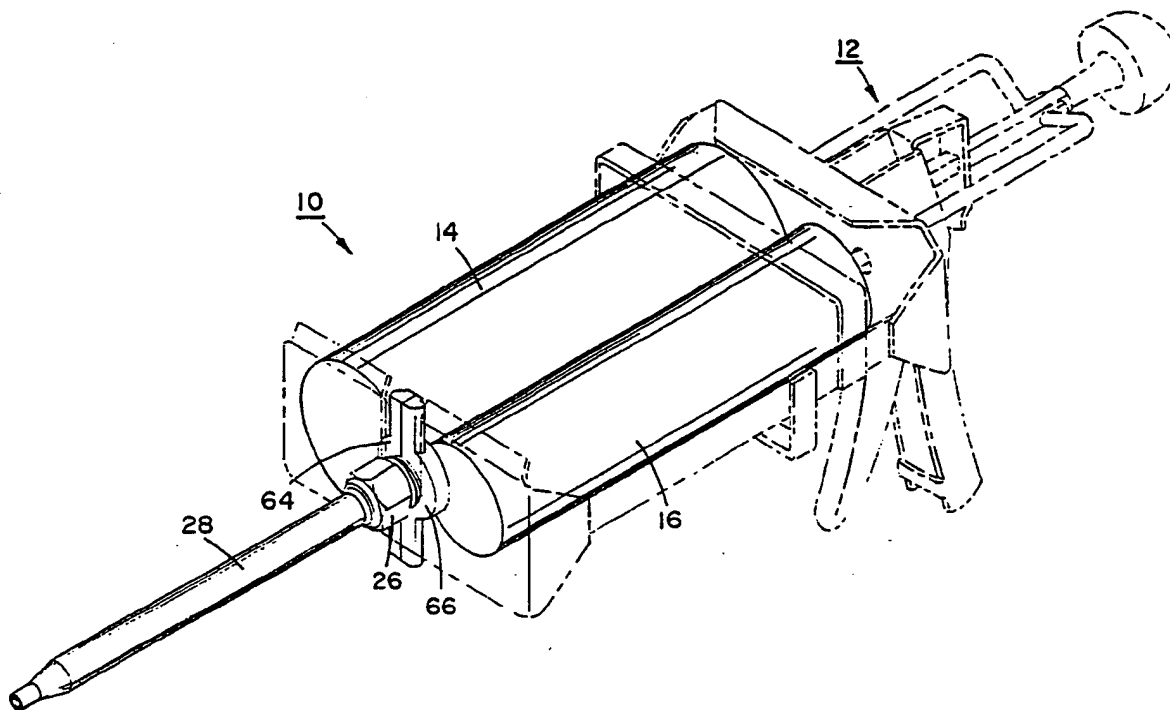
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US90/05889 (22) International Filing Date: 15 October 1990 (15.10.90) (30) Priority data: 422,235 16 October 1989 (16.10.89) US (71) Applicant: PLAS-PAK INDUSTRIES, INC. [US/US]; 40 Industrial Park Road, Niantic, CT 06357 (US). (72) Inventors: DUCKWORTH, George, J. ; 77 Beech Road, Guilford, CT 06437 (US). CLEMENS, Richard, W. ; 68 Bridlepath Drive, Somers, CT 06071 (US). (74) Agent: CROZIER, John, H.; 1934 Huntington Turnpike, Trumbull, CT 06611-5116 (US).		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).  Published With international search report. With amended claims.

(54) Title: CARTRIDGE SYSTEM FOR DISPENSING PREDETERMINED RATIOS OF SEMI-LIQUID MATERIALS



(57) Abstract

The present invention relates to a system for dispensing semi-liquid materials simultaneously and in a predetermined ratio while preventing hazardous leakage to the environment. The present invention overcomes the disadvantages of conventional devices by providing a system which includes two cartridges (14, 16) having the same or selected different diameters, the cartridges being rigidly snapped together by interfitted male and female elements (60, 62, 68, 70, 72, 74). A seal (38) is also provided for each of the cartridges which includes a resilient wiping lip (48) formed around the outer periphery of the seal. Venting grooves are also provided in the inner wall of the cartridge so that air may readily be expelled from the cartridge as the seal is inserted.

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DescriptionCartridge System for Dispensing Predetermined  
Ratios of Semi-Liquid Materials

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Technical Field

The present invention relates to means for dispensing semi-liquid materials generally and, more particularly, to a novel system for dispensing two  
10 such materials simultaneously and in a predetermined ratio.

Background Art

There are a number of circumstances in which it  
15 is desirable to dispense semi-liquid materials in a predetermined ratio. The materials may include reactive, two-component adhesives, sealants, coatings, or potting compounds, in which adhesive one material may comprise a resin compound and the other material a  
20 catalyst. The chemical families of such materials include epoxies, acrylics, silicones, polyesters, urethanes, polyurethane foams, and hybrid and reactive elastomers and adhesives.

In some cases, particularly in the past, it was  
25 necessary to separately dispense one of two materials and then the other and then to mix them. Various devices have been developed to simultaneously dispense the materials in preselected ratios. These devices generally comprise two cylindrical cartridges, or a  
30 single cartridge having two cylindrical bores, for insertion in a cartridge gun which typically has two plungers which move together against seals in one end of the cartridges to dispense the materials from nozzles in the other end of the cartridges. The

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latter type of cartridge has the disadvantage that the manufacturer must inventory a supply of cartridges for each ratio of materials. Some of the former types provide for the use of different size cartridges, but  
5 the cartridges thereof are poorly joined together.

In all known such cartridges, the seals thereof do not provide thorough wiping of the bore of the cartridges and, therefore, the seals may freeze in place, due to hardening of the materials that leak  
10 past them, or hazardous materials may be released into the surrounding environment from leakage around the seals. Also, in known such cartridges, there is no satisfactory provision for venting air from the cartridges as the seals are inserted therein after  
15 filing of the cartridges.

Accordingly, it is a principal object of the present invention to provide a cartridge system for the dispensing of semi-liquid materials in predetermined ratios which system includes two  
20 cartridges of selected diameters rigidly fastened together.

Another object of the invention is to provide a seal for a cartridge for dispensing semi-liquid material which seal includes means for ensuring  
25 thorough wiping of the inner surface of the cartridge.

An additional object of the invention is to provide a cartridge for dispensing semi-liquid material which cartridge includes means for venting air from the cartridge as a seal is inserted into the  
30 cartridge after filling of the cartridge.

A further object of the invention is to provide a system for dispensing semi-liquid materials in predetermined ratios which system is economically manufactured and has easily changed ratios.

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Other objects of the present invention, as well as particular features and advantages thereof, will be elucidated in, or apparent from, the following description and the accompanying drawing figures.

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#### Disclosure of Invention

The present invention accomplishes the above objects, among others, and substantially overcomes the disadvantages of conventional devices by providing, in  
10 a preferred embodiment, a system for dispensing semi-liquid materials in predetermined ratios, which system includes two cartridges having the same or selected different diameters, but proportional to the ratio of the materials to be dispensed, the cartridges being  
15 rigidly snapped together by means of interfitting male and female elements. In another aspect of the invention, there is provided a seal for a cartridge for dispensing semi-liquid material which seal includes a resilient wiping lip formed around the  
20 outer periphery of the seal. In a further aspect of the invention, there is provided a cartridge for dispensing semi-liquid material which cartridge includes grooves formed in the inner wall thereof extending inwardly a distance from the edge of the  
25 filling end thereof so that air may readily be expelled from the cartridge as the seal is inserted after filling of the cartridge.

#### Brief Description of Drawings

30 Figure 1 is a perspective view of the system of the present invention fitted with a motionless mixer and inserted in a cartridge gun.

Figure 2 is a partially cross-sectional view of the system of Figure 1.

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Figure 3 is a side elevation view, in cross-section, of a seal with a wiping lip, according to the present invention.

Figure 4 is a partial front elevation view, in cross-section, showing the means by which the filling ends of the cartridge tubes are snapped together, according to the present invention.

Figure 5 is a front elevation view, partially in cross-section, showing the means by which the dispensing ends of the cartridge tube are snapped together, according to the present invention.

Figure 6 is a perspective view of the filling end of a cartridge showing venting means, according to the present invention.

15

#### Best Mode for Carrying Out the Invention

Referring now to the Drawing, in which the same elements have consistent identifying numerals throughout the various figures, reference should first be made to Figure 1 which shows the system of the present invention, generally indicated by the reference numeral 10, mounted in a cartridge gun, generally indicated by the reference numeral 12. System 10 is shown as being fitted with a motionless mixer 28, the function of which will be discussed below.

While system 10 is shown mounted in a manual, trigger-activated cartridge gun 12, the system may be used as well with conventional pneumatic or screw-advance cartridge guns or it may be used as well with various types of conventional bench-mounted metering systems.

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Referring now also to Figure 2, system 10 includes cartridges 14 and 16 snap fitted together as will be described in more detail below. It can be seen that the respective diameters of cartridges 14 and 16 have been selected so that the cross-sectional area of cartridge 14 is about twice that of cartridge 16, the result of that selection being that twice as much material will be dispensed from cartridge 14 than will be dispensed from cartridge 16 when system 10 is placed in gun 12 (Figure 1) having parallel, coacting plungers. It will be understood that any desired ratio of cross-sectional areas may be chosen and that, regardless of the ratio chosen, the function of the various elements of system 10 will be unchanged.

Cartridge 14 includes a seal 18 for insertion in the filling end of the cartridge and, at the dispensing end of the cartridge, there is formed an outlet nozzle 20. Likewise, cartridge 16 includes a seal 22 for insertion in the filling end of the cartridge and an outlet nozzle 24 formed at the dispensing end of the cartridge. It can be seen that outlet nozzles 20 and 24 each form one-half of a threaded structure over which a bonnet 26 may be threadedly advanced to secure motionless mixer 28 to the dispensing ends of cartridges 14 and 16. Motionless mixer 28, when used, provides thorough mixing of the materials dispensed from cartridges 14 and 16 and is preferably disposable. Motionless mixer 28 need not be used with system 10, however, and, when not so used, the materials will be dispensed directly from outlet nozzles 20 and 24 and will require a separate mixing step.



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When system 10 is not in use, outlet nozzles 20 and 24 may be sealed, respectively, by means of removable end plugs 30 and 32 inserted thereinto.

Figure 3 is a side elevation view, in cross-section, of a seal 38 which may be used in system 10 or may be used in any cartridge. Seal 38 includes a cylindrical shell 40, a flat end portion 42 which bears against the material being dispensed (not shown), a reinforcing structure 44, integral with end portion 42, against which may bear, for example, a piston of a cartridge gun (not shown), and an open end 46 into which the piston may be inserted. It can be seen that the outer surface of cylindrical shell 40 is not of uniform diameter, but the portion thereof adjacent end 42 flares outwardly to form a circumferential resilient lip 48 extending beyond the straight portion of the shell when the lip is in its natural position shown on Figure 3, with the outer portion of the lip terminating in a pointed annular ridge 50 facing outwardly from the central axis of seal 38. When seal 38 is inserted in a cartridge, such as seal 18 on Figure 2 inserted in cartridge 14, the lip would be compressed inward with ridge 50 contacting the inner surface of the cartridge and thoroughly wiping the inner surface as material is dispensed from the cartridge. Lip 48 is given resilience, in part, by means of a trough 52 defined in seal 38 between the lip and end portion 42. Thus, material in the tube is substantially prevented from flowing past seal 38 as material is dispensed from the cartridge, by virtue of lip 48 and ridge 50. The contact between ridge 50 and the inner surface of the cartridge in which seal 38 is inserted also aids in preventing solvent in the material from evaporating.

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Reference to Figures 2 and 4 will illustrate how the filling ends of cartridges 14 and 16 are snapped together. Here, it can be seen that a rectangular male pin 60, having a head portion larger than the base portion, formed on the outer wall of cartridge 14 can fit into a female receptacle 62, having a complementary shape, defined in cartridge 16, by means of temporary deformation of the pin as elements 60 and 62 are joined. It will be understood that the tapers of elements 60 and 62 are shown somewhat exaggerated for clarity.

Reference to Figure 5 will illustrate how the dispensing ends of cartridges 14 and 16 are snapped together. Here, it can be seen that mating bosses 64 and 66 are formed, respectively, on outlet nozzles 20 and 24. A round male pin 68, having a head portion larger than its base portion, formed on boss 64, can fit grippingly into a complementary female receptacle 70 defined in boss 66. Likewise, a round male pin 72, having a head portion larger than its base portion, formed on boss 66, can fit grippingly into a complementary female receptacle 74 defined in boss 64. Pins 68 and 72 are inserted into receptacles 70 and 74, respectively, by means of temporary deformation of the pins. Again, it will be understood that the tapers of elements 68, 70, 72, and 74 are shown somewhat exaggerated for clarity.

Thus, having three points of attachment between cartridges 14 and 16, with one point of attachment in the plane common to the central axes of the cartridges and two points of attachment perpendicular to and spaced apart from the common plane, secures the cartridges against relative axial movement, relative rotational movement, and relative twisting movement.

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The respective elements which allow the snapping together of cartridges according to the present invention have identical dimensions for all sizes of cartridges to permit any selected ratio of sizes thereof to be chosen within the range of cartridges provided. A pair of joined cartridges may also be separated relatively easily, if desired, without damage thereto, and the cartridges may then be joined to other cartridges.

10 Figure 6 shows the means of venting a cartridge after filling. Here, a cartridge 82, of the type described above, has a plurality of slots, as at 84, defined in the inner surface thereof. Slots 84 extend from the edge 86 of the filling end of cartridge 82 a distance inwardly from the filling end, the distance being approximately equal to the distance a seal (not shown) is to be inserted therein. It will be understood that, after cartridge 82 is filled with semi-liquid material (not shown), the seal would be  
15 inserted into the filling end thereof and air would be expelled from the cartridge through slots 84 as the seal is inserted. This arrangement allows the use of a closely fitting seal, such as seal 38 on Figure 3, and also prevents the trapping of air within a  
20 cartridge which would tend to dry out or, in some cases, catalyze the hardening of, the material in the cartridge.

The various elements of system 10 may be conveniently and economically manufactured by  
30 injection molding and preferably are manufactured by injection molding of high density polyethylene.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since

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certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing

5 figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described  
10 and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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Claims

1. A cartridge system for use in simultaneously dispensing a predetermined ratio of semi-liquid materials, comprising:
- (a) two cylindrical cartridges having selected cross-sectional areas in proportion to said predetermined ratio, each said cartridge having a first, open, filling end and a second, closed, dispensing end with an outlet nozzle formed therein;
  - (b) each said cartridge having a seal slidably disposed in the bore thereof to cause a semi-liquid material to be dispensed from said outlet nozzle when force is applied to said seal; and
  - (c) attachment means to rigidly snap together said two cartridges.
2. A system, as defined in Claim 1, wherein said attachment means comprises a plurality of male pins and female receptacles disposed in opposing pairs, each said opposing pair comprising one said male pin protruding from one of two mating surfaces of said two cartridges and one said female receptacle defined in the other of said two mating surfaces of said two cartridges, such that, when said surfaces are mated, said male pin is grippingly held within said female receptacle.

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3. A system, as defined in Claim 2, wherein said male pins have head portions larger than their base portions and said female receptacles have dimensions complementary to the dimensions of said male pins, such that said male pins may be snappingly inserted into said female receptacles by means of temporary deformation of said male pins as said male pins are being inserted into said female receptacles.

4. A system, as defined in Claim 2, wherein one of said opposing pairs is disposed in proximity to said first ends of said cartridges, and at least one of said opposing pairs is disposed in proximity to said second ends of said cartridges.

15

5. A system, as defined in Claim 4, further comprising:

- (a) said mating surfaces include surfaces of bosses formed at said second ends; and
- (b) two pairs of said opposing pairs connect said bosses, such that said two pairs of said opposing pairs lie spaced apart substantially on a plane orthogonal to a plane on which the longitudinal axes of said cartridges lie.

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6. A system, as defined in Claim 1, wherein each of said seals comprises:

- 5 (a) a generally hollow, cylindrical shell portion having an open, first end and a closed, second end having a flat portion orthogonal to the major axis of said cylindrical shell portion; and
- 10 (b) said cylindrical shell portion having an outwardly facing lip formed around, and extending beyond, the outer periphery thereof.

7. A system, as defined in Claim 6, wherein the outer periphery of said lip terminates in an

15 outwardly facing, pointed ridge.

8. A system, as defined in Claim 6, wherein said lip is in proximity to said second end of said seal.

20 9. A system, as defined in Claim 8, further comprising an annular trough defined between said lip and said flat portion.

25 10. A system, as defined in Claim 6, further comprising a reinforcing structure formed integrally with said flat portion within said cylindrical portion.

30 11. A system, as defined in Claim 1, further comprising at least one venting channel defined in the inner periphery of each said cartridge, said at least one venting channel extending inwardly from the edge of said filling end.

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12. A system, as defined in Claim 11, wherein said at least one venting channel extends inwardly a distance approximately equal to the distance said seal would be inserted in said each said cartridge.

5

13. A seal for axial movement within a cartridge to dispense a semi-liquid material from said cartridge when force is applied to said seal, comprising:

10 (a) a generally hollow, cylindrical shell portion having an open, first end and a closed, second end having a flat portion orthogonal to the major axis of said cylindrical shell portion; and

15 (b) said cylindrical shell portion having an outwardly facing lip formed around, and extending beyond, the outer periphery thereof.

20 14. A seal, as defined in Claim 13, wherein the outer periphery of said lip terminates in an outwardly facing, pointed ridge.

25 15. A seal, as defined in Claim 13, wherein said lip is disposed in proximity to said second end of said seal.

30 16. A seal, as defined in Claim 15, further comprising an annular trough defined between said lip and said flat portion.



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17. A seal, as defined in Claim 13, further comprising a reinforcing structure formed integrally with said flat portion within said cylindrical portion.

5

18. A self-venting cartridge for expelling air therefrom when a seal is inserted therein after filling of said cartridge with a semi-liquid material, said cartridge comprising:

10

(a) a cylindrical body having an open filling end; and

(b) at least one channel defined in the inner surface of said cylindrical body, said channel extending inwardly from the edge of said filling end.

15

19. A self-venting cartridge, as defined in Claim 18, wherein said channel extends inwardly a distance approximately equal to the distance said seal would be inserted after said filling of said cartridge.

20

20. Every novel system, apparatus, method, or article disclosed herein.

25

**AMENDED CLAIMS**

[received by the International Bureau  
on 25 February 1991 (25.02.1991);  
original claims 6 and 13 amended;  
other claims unchanged (2 pages)]

6. A system, as defined in Claim 1, wherein  
each of said seals comprises:

- 5 (a) a generally hollow, cylindrical shell  
portion having an open, first end and a  
closed, second end having a flat portion  
orthogonal to the major axis of said  
cylindrical shell portion, the outside of  
said flat portion to bear against said semi-  
liquid material and the inside of said flat  
10 portion to be engaged by a piston of a  
cartridge gun; and
- (b) said cylindrical shell portion having an  
outwardly facing lip formed around, and  
extending beyond, the outer periphery  
15 thereof.

7. A system, as defined in Claim 6, wherein  
the outer periphery of said lip terminates in an  
outwardly facing, pointed ridge.

20

8. A system, as defined in Claim 6, wherein  
said lip is in proximity to said second end of said  
seal.

25 9. A system, as defined in Claim 8, further  
comprising an annular trough defined between said lip  
and said flat portion.

30 10. A system, as defined in Claim 6, further  
comprising a reinforcing structure formed integrally  
with said flat portion within said cylindrical  
portion.

35 11. A system, as defined in Claim 1, further  
comprising at least one venting channel defined in the  
inner periphery of each said cartridge, said at least  
one venting channel extending inwardly from the edge

12. A system, as defined in Claim 11, wherein said at least one venting channel extends inwardly a distance approximately equal to the distance said seal would be inserted in said each said cartridge.

5

13. A seal for axial movement within a cartridge to dispense a semi-liquid material from said cartridge when force is applied to said seal, comprising:

- 10 (a) a generally hollow, cylindrical shell portion having an open, first end and a closed, second end having a flat portion orthogonal to the major axis of said cylindrical shell portion, the outside of  
15 said flat portion to bear against said semi-liquid material and the inside of said flat portion to be engaged by a piston of a cartridge gun; and  
20 (b) said cylindrical shell portion having an outwardly facing lip formed around, and extending beyond, the outer periphery thereof.

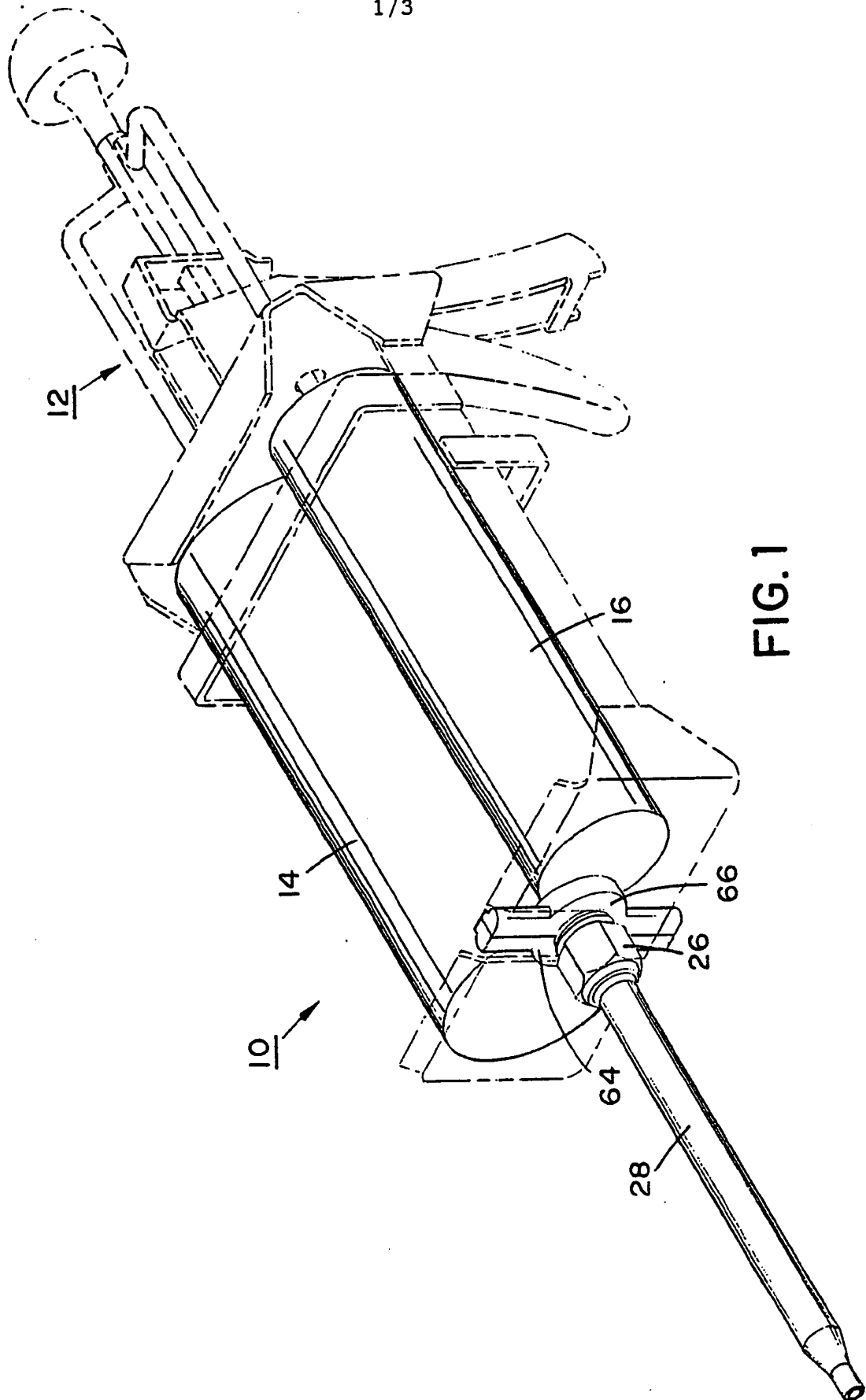
14. A seal, as defined in Claim 13, wherein the  
25 outer periphery of said lip terminates in an outwardly facing, pointed ridge.

15. A seal, as defined in Claim 13, wherein said lip is disposed in proximity to said second end  
30 of said seal.

16. A seal, as defined in Claim 15, further comprising an annular trough defined between said lip and said flat portion.

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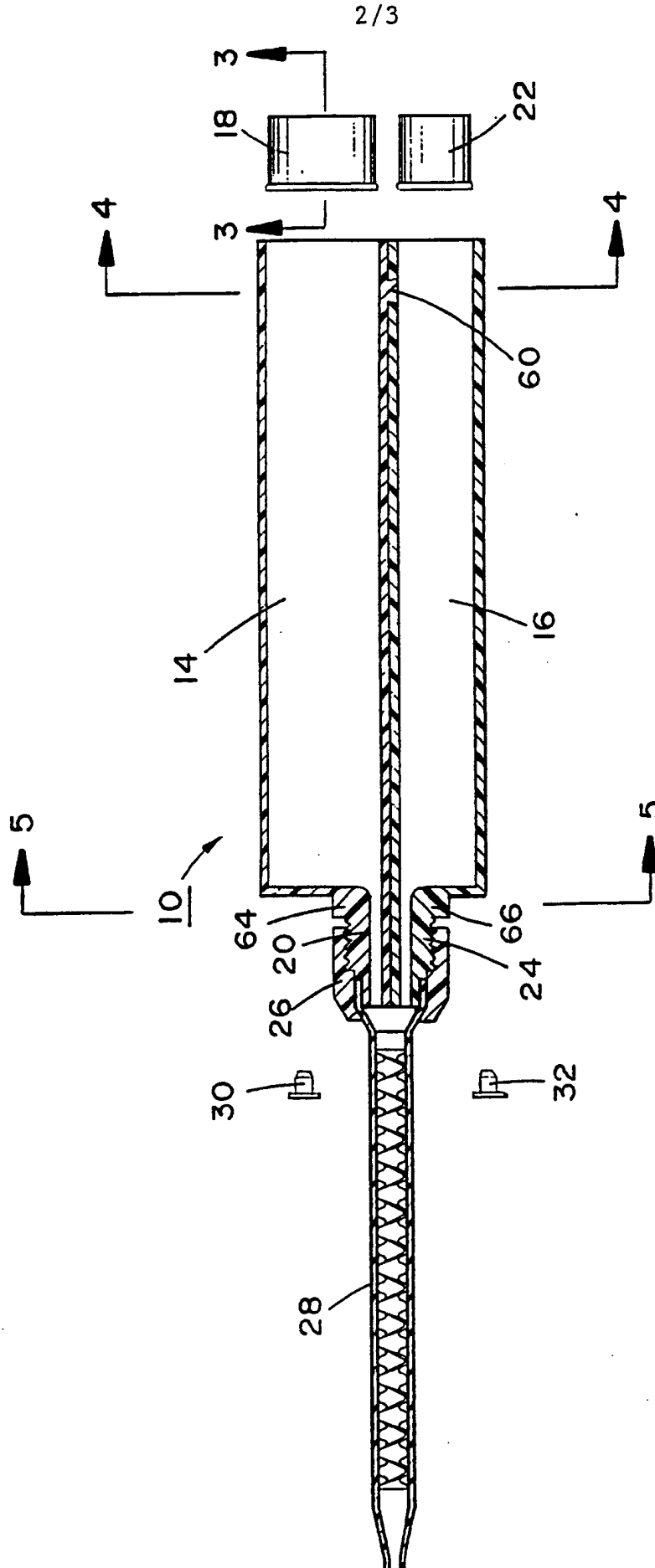


FIG. 2

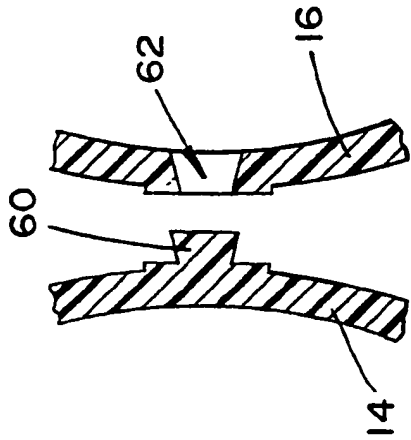


FIG. 4

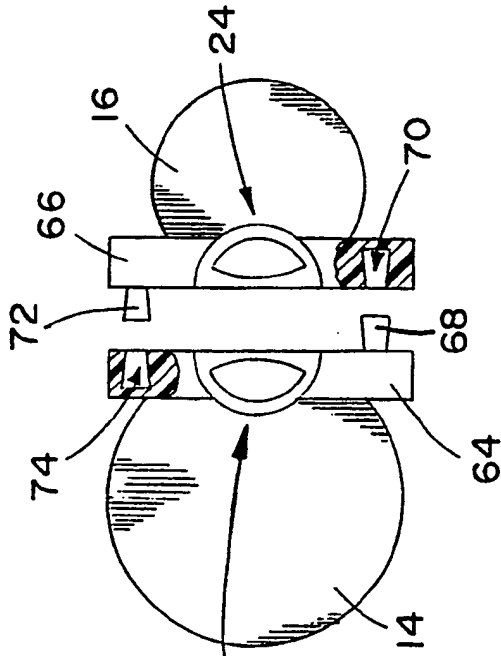


FIG. 5

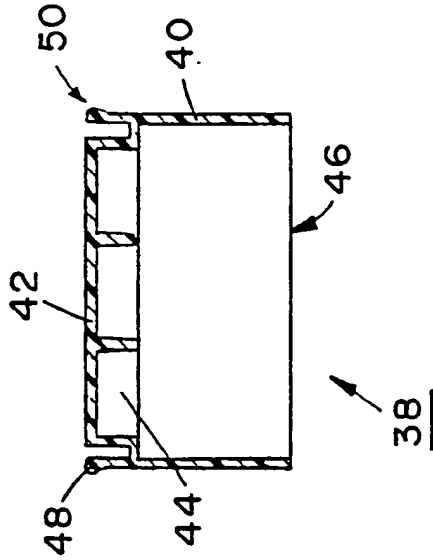


FIG. 3

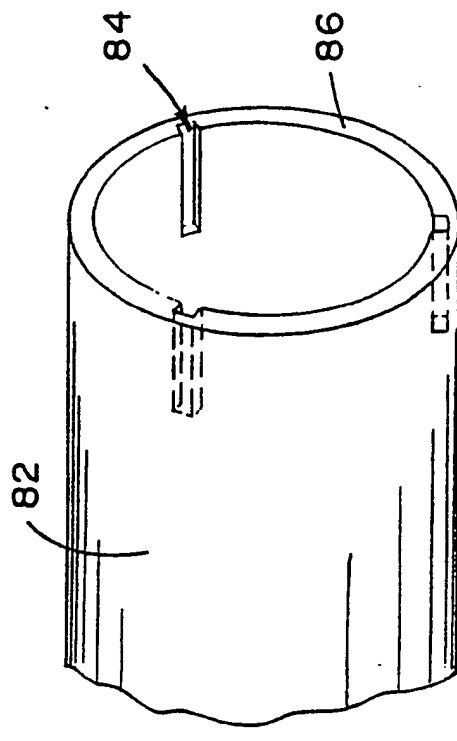


FIG. 6

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US90/05889

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): B67D 5/00 US. CL.: 222/137																							
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched <sup>4</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">U.S.</td> <td style="padding: 5px;">222/94, 135, 136, 137, 145, 386, 387; 403/334, 361, 381; 220/4B, 4E, 23.4; 206/221</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup></div>			Classification System	Classification Symbols	U.S.	222/94, 135, 136, 137, 145, 386, 387; 403/334, 361, 381; 220/4B, 4E, 23.4; 206/221																	
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category <sup>*</sup></th> <th style="border-bottom: 1px solid black;">Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup></th> <th style="width: 15%; border-bottom: 1px solid black;">Relevant to Claim No. <sup>18</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,260,077 (SCHROEDER), 07 April 1981, See entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-4,6-12</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 3,366,265 (HESSELBARTIJ), 30 January 1968, See col. 1, lines 40-50 and 55-60, and col. 3, lines 13-41.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-4,6-12</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,169,547 (NEWELL) 02 October 1979, See figure 1.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">6-10,13-17</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,560,352 (NEUMEISTER ET AL.), 24 December 1985. See col. 3, lines 35-39.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">7,14</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;"><u>X</u> <u>Y</u></td> <td style="padding: 5px;">US, A, 4,830,229 (BALL), 16 May 1989, See col. 5, lines 28-36.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">18-19 11-12</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4,836,423 (HAYES ET AL.), 06 June 1989.</td> <td></td> </tr> </table>			Category <sup>*</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>	Y	US, A, 4,260,077 (SCHROEDER), 07 April 1981, See entire document.	1-4,6-12	Y	US, A, 3,366,265 (HESSELBARTIJ), 30 January 1968, See col. 1, lines 40-50 and 55-60, and col. 3, lines 13-41.	1-4,6-12	Y	US, A, 4,169,547 (NEWELL) 02 October 1979, See figure 1.	6-10,13-17	Y	US, A, 4,560,352 (NEUMEISTER ET AL.), 24 December 1985. See col. 3, lines 35-39.	7,14	<u>X</u> <u>Y</u>	US, A, 4,830,229 (BALL), 16 May 1989, See col. 5, lines 28-36.	18-19 11-12	A	US, A, 4,836,423 (HAYES ET AL.), 06 June 1989.	
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<u>X</u> <u>Y</u>	US, A, 4,830,229 (BALL), 16 May 1989, See col. 5, lines 28-36.	18-19 11-12																					
A	US, A, 4,836,423 (HAYES ET AL.), 06 June 1989.																						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																							
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search <sup>2</sup>   <div style="text-align: center;">26 DECEMBER 1990</div> </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report <sup>3</sup>   <div style="text-align: center; font-size: 1.2em; font-weight: bold;">06 FEB 1991</div> </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority <sup>1</sup>   <div style="text-align: center;">ISA/US</div> </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer <sup>20</sup>  <div style="text-align: center;">              ANTHOULA POMRENING           </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <sup>2</sup>  <div style="text-align: center;">26 DECEMBER 1990</div>	Date of Mailing of this International Search Report <sup>3</sup>  <div style="text-align: center; font-size: 1.2em; font-weight: bold;">06 FEB 1991</div>	International Searching Authority <sup>1</sup>  <div style="text-align: center;">ISA/US</div>	Signature of Authorized Officer <sup>20</sup> <div style="text-align: center;">              ANTHOULA POMRENING           </div>																	
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